

## CHAPTER 7

# Easy PC Systems

### INDUSTRY EARLY REVIEW DRAFT V.0.3 — 07/21/1999 7:35 AM—

**NOTE to REVIEWERS:** This is a very early draft version, and no effort has been made to reconcile changes in cross references to other chapters in the guide. Please look for comments such as this in the draft, which encourage your feedback on specific issues.

**Please submit comments using the form on <http://www.pcdesguide.org> or by sending e-mail to [comments@pcdesguide.org](mailto:comments@pcdesguide.org).**

**IMPORTANT:** The requirements defined in this guide provide guidelines for designing PC systems that will result in an optimal user experience with typical Windows-based applications running under either the Microsoft Windows98 “Millennium” or later or Windows2000 Professional or later operating systems. These design guidelines are not the basic system requirements for running any version of Windows operating systems.

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## Easy PC Platform Architecture

As explained in an earlier initiative chapter , the goals of the Easy PC initiative are to deliver a desktop consumer PC that is significantly:

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- ?? Easier to Setup
- ?? Easier to Use
- ?? Easier to Expand
- ?? Easier to Maintain

This chapter describes the architectural features, technology elements and integration methodology of the Easy PC. It is intended that starting in 2001, a significant majority of consumer PCs will be implemented to the guidelines presented in this chapter. Current implementations are already integrating many of these features.

The following are the Easy PC architecture focus areas:

- ?? Roadmap for Legacy Removal including I/O connectors, silicon, BIOS and consideration for manufacturing and test
- ?? Instantly Available/ On Now technology, covering the areas of Simple Boot Flag based Fast Post, One-button capabilities and guidelines for Power Delivery and Acoustics
- ?? To-The-Home and In-The-Home connectivity addressing ISP configuration, automated networking and remote wakeup
- ?? External Expansion including USB, USB2.0 (when available), Device Classes, number and location of ports, power budgeting for remote wakeup, USB mapper devices
- ?? High functional integration on motherboard including modular Build-to-Order/ Configure-to-Order options
- ?? Image integration, Hard Drive and BIOS recovery, diagnostics, support
- ?? Configuring for best Out-of-Box Experience

Some of these focus areas are presented in the 0.3 draft of this document for completeness although implementations are outside the scope of the \_PC 2001 SDG.

## Legacy Removal roadmap

### Background

To improve system performance, reduce customer support costs, and ensure true ease of use in PC systems and peripherals, manufacturers must plan to migrate all components in their systems away from ISA and legacy devices. This migration is already being implemented as follows:

- ?? PC 97 design guidelines eliminated non-Plug and Play devices from new systems.

- ?? PC 98 guidelines eliminated add-on devices that use legacy ports or the ISA bus, including game devices that use proprietary ports.
- ?? PC 99 guidelines eliminated user-accessible ISA slots and required PCI, USB, AGP, or other non-legacy solutions for all devices, except printers. PC 99 guidelines encouraged USB solutions, but allowed OEMs to continue to provide legacy mouse devices and keyboards, but not legacy game devices.

The PC 2001 guidelines assume that PC 99 goals have already been adopted by the system designer. This section describes the last few steps to removing legacy elements from the Easy PC implementation. Note that the legacy removal roadmap can apply for workstation, mobile, desktop, and server systems that are not designed to meet the other goals of the Easy PC Initiative.

**Note to Reviewers:** Microsoft is investigating the development of non-retail versions of Windows 98 and Windows 2000 operating systems that will support PC systems that do not use legacy components such as Super I/O, the 8042 controller, and MS-DOS. Supporting system features being proposed for the next OEM service release of Windows 98 (Windows “Millennium”) include the following:

- ?? All Windows dependency on Super I/O and 8042 eliminated.
- ?? USB HID detection during boot.
- ?? Native support for more USB device classes, including printer, storage and broadband modem plus Serial-to-USB and Parallel-to-USB mappers.
- ?? Native S4 support (Suspend to Disk), with operating system recovery in under 8 seconds, and S3 resume in under 5 seconds.
- ?? More device support through ACPI.
- ?? Mechanism to return to a previous known, good configuration.

Reviewers can read the legacy-free description here with these potential Windows 98 capabilities in mind. It is important to note, however, that the actual feature set of Windows Millennium has not been announced, and the above list should not be considered a commitment from Microsoft. The feature set for the next release of Windows Millennium will be known before the completion of PC 2001 guidelines.

## Legacy-Removal Guidelines for Easy PC Systems

The guidelines listed here describe components and solutions that the system designer must consider in creating an Easy PC system.

**Note to Reviewers:** Please note that the list below is from initial architectural discussions and the formal requirements will be defined later in this chapter. As those requirements are solidified, this list will be

**removed and the final requirements will be reflected at the end of the chapter.**

**An Easy PC system must ensure the following legacy components are removed:**

- ?? No BIOS boot dependencies on ISA or other legacy devices, and no ISA-related components appear on BIOS setup screen.
- ?? No game, serial, parallel, or legacy IR controllers (typically contained in Super I/O); USB connection for external I/O devices; wireless capability, if present, must be NDIS 5.0 compliant
- ?? No 8042 controller (typically contained in Super I/O)
- ?? No floppy disk controller (typically contained in Super I/O).

**An Easy PC system must retain/ include the following components:**

- ?? An ACPI 1.0-compliant, wired Advanced Programmable Interrupt Controller (APIC).
- ?? A system timer that uses IRQ 0.
- ?? Two free USB ports for end user's expansion, to provide connectivity in addition to the connection for a USB keyboard and mouse. (This may be implemented as either one or two USB 1.0-compliant host controllers.)
- ?? Relocatable VGA support (as originally defined in PC 97 guidelines), for boot and multi-monitor support.
- ?? Internal debug header interface that allows a diagnostic serial port adapter. (A future debug capability will be described in a later revision of this guide.)
- ?? A BIOS that meets all PC 2001 requirements for CD boot support, fast POST, and keyboard scan codes, plus specific requirements as described in the "Easy PC Systems" chapter in this guide.

**Note to Reviewers: Please send us your comments on the following components.**

- ?? An ACPI based hard reset/reboot mechanism .

**Additionally, the following system integration guidelines must be observed:**

- ?? Only non-legacy peripherals are bundled with the system. In particular, a USB keyboard and mouse are provided, with BIOS support for the keyboard as a boot device and for the mouse
- ?? Hardware components bundled with the system have no dependency on Microsoft MS-DOS®.
- ?? No FDC-based floppy drive is provided with the system, and the related FDC hardware and BIOS support are removed from the system. If a floppy disk drive is provided, it must connect through USB or other non-legacy option.

- ?? System recovery media is provided only on CD media.
- ?? IEEE 1394 and Device Bay might be implemented as additional expansion options.

## Instantly Available/ On Now

An Easy PC must deliver robust "Always On and Connected" capability. The corresponding Intel and Microsoft enabling initiatives are Instantly Available and On Now.

The architecture includes:

- ?? An ACPI BIOS provides both system controlled configuration and power management of systems and devices
- ?? Dual-mode power delivery that provides headroom for normal operation and auxiliary power during suspend and recovery
- ?? Low noise cooling that dynamically scales with ambient and actual dissipation
- ?? Silent operation in the suspended state
- ?? Software aided budgeting of auxiliary power and management of power states across an expandable mix of wakeup sources

The platform implementation should ensure that the user has no reason to reboot the PC between use sessions. The user must see the PC as instantaneously available, with a startup experience similar to turning on a TV, so as to encourage spontaneous and frequent use. The Easy PC should exhibit the following attributes: robustness across multiple sessions, easy and rapid on/off, quiet operation in the on state, low wattage in the off state, responsive to network and modem wakeup from the off state, comprehend dynamic reconfiguration of USB and network subsystems.

## Suspend/Resume

The Easy PC must have a robust system level power management design. The HW and SW subsystems must be coordinated to deliver a robust implementation that operates simply and consistently across usage cycles. If the power management is not reliable, the user will prefer to shutdown and reboot the system with each use, effectively limiting the use of the PC to "big" tasks. The implementation must comprehend expansion of HW and SW functions to the initial configuration. Any user options must be easy to comprehend and select and require zero maintenance.

## POST/Boot

The Easy PC must deliver a rapid and silent boot. Reduction or elimination of legacy interfaces and devices should be leveraged to simplify the startup process.

The ACPI tables must declare all HW capability, eliminating the need for peek and poke discovery of devices and configurations. During boot, the system should display no user messages, strings or prompts, and the user screen should be directly presented. Any diagnostic modes or setup screens should not be entered during normal boot sequence.

The Simple Boot Flag specification (reference) must be implemented in the BIOS. This allows BIOS post and OS boot process to be simplified based on a successful prior boot entry. Any Video Option ROM present must observe the Simple Boot Flag to minimize video test sequences. Likewise network adapters should leverage the SBF as appropriate to minimize boot time discovery.

**Note to Reviewers: Recovery from Power Failure will be addressed in a future update.**

## On/Off Buttons

An On/Off power button, that operates synonymous with a TV's power button is accessibly located in front of PC or integrated as a USB/HID device in the monitor or in keyboard. This button should complement any user interface capability in the operating system. A future revision may define the semantics for button operation to include movement between different suspend levels and its relationship to the main PC power switch.

Additional hard or soft programmable button implementations could include Internet access functionality, mail retrieval functionality, or other operations that need frequent convenient access.

## Power Delivery

The power supply and voltage regulator circuitry must be dual mode. During normal operation, the capacity should be sufficient to allow full performance headroom and power support for all slots and connectors. On the other hand, elimination of ISA slots (estimated at 15W per slot) and reduction or elimination of PCI slots (estimated at 10W per slot) allows significant reduction of power delivery capacity. During the suspended state, the power delivery switches to the auxiliary mode, which allows maintenance of system state and resume capacity.

The power-budgeting software must comprehend auxiliary capacity and allow a variable number of wakeup devices to be supported. Wakeup devices include front panel on/off button, USB based on/off button built into the monitor or keyboard, AMR/PCI/USB based modem controller, AMR/PCI/USB based DSL controller, PCI or motherboard based LAN controller, PCI or USB based HPNA controller.

For USB, the recently approved USB Interface Power Management Specification allows up to 100mA of 5V suspend and wakeup current for wakeup devices. Power-budgeting software should comprehend actual power required by devices

configured for wakeup. For USB ports, 100mA of 5V power needs to be budgeted for every open port to allow a plug in event to be supported in the suspended state that do not have devices plugged in at the time of system suspend. Alternatively port power may be disabled, so that plugging in a device into a suspended system does not result in a wakeup event. Mobile considerations are explicitly not covered in these discussions. Mobile power considerations may be significantly different.

## Acoustics

For improved user experience, the Easy PC designers should also consider environmental factors such as noise. Information is provided on acoustics for completeness, not as a platform design requirement.

Designing for low acoustics levels is essential. This goal implies minimizing noise generated from fans and disk drives. Noise from fans primarily is below 1KHz and noise from disks is in the 1KHz to 4KHz range. Typically, noise is measured either in units of sound pressure (dBA) or sound power (bel). The specifications for these measurements are ISO 7779 and ANSI S12.10. An A-weighted model is used to scale the noise to the characteristics of the human ear's perception. Using traditional methods, noise pressure is measured at the operator position and must be within the bounds specified under these requirements both for normal platform operation and in the platform's suspended state. In the future, it is possible that the preferred method for measuring sound will be sound power rather than sound pressure, or some combination of these two methods.

To minimize fan noise, the design may support fan speed control using pulse-width modulation or linear control. This support requires monitoring of system hot spots and turning up the fan only as necessary, thereby minimizing fan noise. It is particularly important not to have the fan intermittently switch between full on and off, as this is even more distracting to the user than having the fan be always on.

The selection and placement of the fan(s) is particularly relevant to reducing noise. Typically, the noise from fans that are within the enclosure, such as attached to CPU heat sinks, is attenuated before it escapes the chassis. Equivalent air flow from large fans can be delivered at lower rpm than smaller fans, resulting in lower noise. Internal baffles and ducts can be used to direct air efficiently to relevant subsystems, thereby reducing total air flow requirements. Fans that pull air into the chassis are more efficient than fans that blow air out of the chassis. Placement of fans should direct the air outlet away from the user.

In the suspended state, the implementation must support self-cooling without use of the fan other than possibly as a failsafe backup for unusually high ambients.

## Connectivity and External Expansion

An Easy PC must provide for Connectivity and External Expansion. Requirements in the following sections will address the implications of configuring a system to be ready for Broadband and home networking.

### USB

USB is the port for external expansion, superceding legacy connectors and preferred over internal user expansion. In addition to the included USB-based keyboard and USB mouse, the configuration must include 2 spare USB ports for user expansion. These ports must be clearly identified and accessible. USB ports located in the back of the chassis are convenient for network adapters and other relatively stable peripherals such as a printer or scanner. USB ports located in the front of the chassis or in the monitor or keyboard are more convenient for occasionally attached or interactive use devices.

The BIOS must provide USB support for the keyboard and mouse. USB based secondary boot devices are not recommended.

The USB implementation must support Suspend/Resume of the platform, requiring configuration to be maintained by the device and allowing wakeup by selectively configured devices. This support has specific implications on power delivery and motherboard power plane design.

The load image must include support for USB device classes (identify which specific ones). Additionally, support for mappers to legacy adapters (identify which specific ones).

The requirements section below also covers IEEE 1394 and Cardbus expansion capabilities.

## Maintenance

The CD-ROM or DVD is the secondary boot and recovery device. The *El Torito Bootable CD-ROM Format Specification*, Version 1.0, provides the requirements for this capability and can be found at <http://www.phoenix.com/products/specs-cdrom.pdf>.

## Configuring for Improved System OOBE

Delivering a fast and friendly first-use experience requires specific attention to HW and SW integration. The goal is to enable a novice user to set up and begin using a new Windows-based PC in 15 minutes, with no outside assistance. In addition to OEM practices such as pre-configuring the system and supplying various help mechanisms, the system itself should be designed and loaded to boot quickly.



**Preboot and Startup Best Practices.** These guidelines describe how to improve the user's experience in turning on the PC and starting the operating system.

- ?? Fast (or no) POST, with minimal start-up display (PC 2001 BIOS requirement).
- ?? Minimal, full-screen start-up display, with no text-based display for BIOS or operating system load. [PC 99 requirement 3.4.1]
- ?? [PC 99 requirement 3.4.3]
- ?? Preconfigure the system so that from first power on to Window occurs as fast as possible:
  - ?? Load the fewest possible DLLs, utilities, and programs during boot.
  - ?? Ensure that preinstalled applications and utilities don't require a system reboot.
  - ?? Don't run any preinstalled application until the user launches it.
  - ?? Present a friendly, welcoming Windows initialization screen.

## Easy PC Platform Requirements

This part of the chapter describes the hardware requirements for a PC designed to meet the goals of the Easy PC Initiative.

**Note to Reviewers: The remainder of this draft focuses on requirements for DESKTOP Easy PC implementations. Variations and guidelines for mobile PCs are outside the scope of the Easy PC program today.**

If there is a conflict with requirements made elsewhere in this guide, the items in this chapter apply for Easy PC systems. Unless a specific requirement or exception is defined in this chapter, all PC 2001 requirements apply as defined in Chapter X, "PC 2001 Core Architecture"

## Easy PC System Performance Requirements

This section defines minimum performance requirements for Easy PC systems.

### X.1. System performance meets Desktop system minimum requirements

Minimum Easy PC system performance requirements include the following:

- ?? Microprocessor performance equivalent to an Intel Architecture 500 MHz or greater processor
- ?? 128 MB RAM, minimum

**Note:** The graphics subsystem solution must meet PC 2001 performance requirements as defined in Chapter x.

## Legacy-Free Requirements

This section defines the hardware requirements for Easy PC systems. In general, Easy PC systems need a higher level of legacy removal, so the requirements are equal to or better than the Desktop requirements in terms of legacy removal.

### **X.2. Easy PC supports ACPI 1.x, wired APIC, and timer circuit**

The Easy PC system must support the following:

- ?? *ACPI Specification, Revision 1.x* or later, including support defined in Revision 1.x for reporting legacy-free and hard reset/boot capabilities.
- ?? Advanced Programmable Interrupt Controller (APIC) implemented and properly connected so that the system can be configured either in APIC mode or in the standard PIC (“virtual wire”) mode. Both these modes must be supported for system to boot properly.
- ?? Timer, using IRQ 0

### **X.3 Easy PC meets minimum legacy hardware removal requirements**

An Easy PC system must achieve this minimum level of legacy hardware removal:

- ?? No ISA slots or any embedded or integrated ISA devices (a requirement for all PC 99 and PC 2001 systems)
- ?? No Super I/O chip or Super I/O-dependent components (that is, no 8042 controller and no serial, parallel, PS/2, or IR ports)
- ?? No floppy disk controller (FDC)
- ?? No legacy game or MIDI ports on any bus interface

**Note to Reviewers: Please comment on how removal of the 8042 device impacts your current plans.**

### **X.4 Easy PC meets minimum I/O hardware requirements**

The Easy PC desktop system must include the following minimum hardware support:

- ?? System ships with two free USB ports for end user expansion. These ports are in addition to those that can be used for the keyboard and mouse expansion. For example, this guideline can be implemented as two USB 1.1-compliant host controllers with four ports.
- ?? HID-compliant USB keyboard and USB mouse.
- ?? Relocatable VGA for boot support and multi-monitor support (as originally defined in *PC 97 Hardware Design Guide*).
- ?? Digital Video Interface that meets PC 2001 requirements as defined in Chapter X, “Graphics Adapter.”

- ?? El Torito-boot compliant CD-ROM or DVD drive, and hard disk drive.
- ?? No internal floppy drive based on FDC. A system can use internal or external Floppy based on a deterministic interface such as USB.

In addition, the system manufacturer must make the following available to customers, either by providing the adapter and appropriate drivers with the system or offering it as an additional item for purchase:

- ?? USB-to-parallel printer port dongle, compliant with *USB Device Class Definition for Printing Devices, Version 1.0*.
- ?? USB-to-serial modem dongle, compliant with *USB Device Class Definitions for Communications Devices, Version 1.0*.

**Note to Reviewers: Please comment on how these adapter requirements impact your current plans.**

#### **X.5 Preinstalled platform software components ensure easy-to-use interface for the end user**

The pre-installed components and system configuration for an Easy PC system must meet these requirements:

- ?? MS-DOS must not be required to install or run any utilities, games, or other software provided with the system.
- ?? System recovery software, BIOS upgrades, or other upgrades for the system must not require the system to boot from a floppy disk.

**Note to Reviewers: Please comment on how both the lack of a floppy disk and MS DOS not being required for software installation impacts your current roadmaps. This requirement is still under review.**

#### **X.6 Easy PC meets minimum BIOS requirements for legacy removal**

An Easy PC system must achieve this minimum level of BIOS support for legacy removal and support of replacement technologies:

- ?? No BIOS boot dependencies on ISA or other legacy devices, and no ISA-related components appear on BIOS setup screen.
- ?? No hardware emulation of 8042

**Note to Reviewers: Please comment on how the 8042 emulation requirement impacts your current roadmaps.**

- ?? Support HID boot protocols for USB input devices, as defined in *USB PC Legacy Compatibility Specification, Version 0.9* or later.
- ?? Assert A20.

A20 must always be asserted by the hardware, with no way to mask the A20 address line.

Ensure that ROM BIOS APIs and interrupt handlers do not change the high 16 bits of 32-bit registers.

The operating system requires that these registers do not change.

?? Support required BIOS dependencies.

**Note to Reviewers: This complete list is still TBD, but will be completely defined in the next draft of these guidelines. At a minimum, this is expected to include:**

**INT 8**

**INT 10 - All subfunctions must be present**

**INT 11 (equipment determination)**

**INT 13 (disk operation) - All subfunctions, including AH = 40h - 48h)**

**INT 15 AH = C0h, E4h, 4Fh, 87h, 88h**

**INT 15, AX=E820**

**INT 16 AH = 00h, 01h, 10h, 11h**

**INT 1Ah - All subfunctions**

?? A CMOS clock that can handle years before or after 2000 (INT 1Ah functions AH == 2,3,4,5) must always be present.

?? Support the timer at system boot. The ROM BIOS must make sure that the timer is on at system boot and that timer interrupts are occurring as part of POST or RESET.

## Ease-of-Use Requirements for Easy PC Systems

This section defines ergonomic and system design factors that affect how easy it is for the user to set up, use, and maintain an Easy PC system.

### **X.7 Expansion capabilities are accessible to end user**

The intent of this requirement is that the end user finds the PC to be expandable without having to open the PC case.

External expansion capabilities on an Easy PC system are provided through USB and other interfaces covered in Connectivity and External Expansion.

This requirement does not preclude system manufacturers from including PCI slots for build-to-order operations. Easy PC systems may include one or more internal PCI slots for user upgrade.

It is assumed that an Easy PC system does *not* accommodate replacing key components such as the graphics subsystem, but system designs might accommodate adding functionality, such as a second graphics adapter to allow multiple-monitor capabilities.

### X.8 System meets Easy PC power button requirements for system boot, sleep, and shut down

**Note to Reviewers:** Intel and Microsoft are currently working with the industry to define the behavior that a user will experience with the “power switch” on all PC 2001 systems. This requires changing how PC systems work. The new model that is defined must be consistent across ALL PCs moving forward. Thus, as the new behavior is learned, users will have the same experience on all PCs.

The intent is that on a PC 2001 system, the user has to understand only two system states: On/running and low power/standby.

When the user presses the button, the system will respond by either going into the low power/standby state or the user will receive a message to indicate why the system cannot be put on standby (like connection sharing).

On the PC system unit, a single sleep button/reset switch must be the only option for controlling the power state.

An additional sleep button/reset switch can also be located on an input device or on a separate monitor. The implementation for controlling power must be identical on all switches provided.

The manufacturer must provide clear directions to the user on how to use only the sleep button and the Start menu option in the Windows interface to control the system’s power state.

**Note to Reviewers:** Please comment on how the power button functionality impacts your product designs. For example, what the difference between a blank screen saver and standby, from the user’s perspective? Also, the ACPI based hard reset/reboot mechanism needs to work in concert with the power button functionality. Note that the system manufacturer will define the actual state of the low power/standby mode.

### X.9 Preinstalled additional software components ensure easy-to-use interface for the end user

The pre-installed additional software components and system configuration for an Easy PC system must meet these requirements:

- ?? All preinstalled software, including utilities and components included with hardware peripherals, must meet the goals for software reliability and usability as defined in *Windows 2000 Application Specification for Desktop Applications, Version 1.0* or later

**Note to Reviewers: Additional usability guidelines for Easy PC systems that run Windows will be defined in a future document. This requirement is still under review.**

#### **X.10 System ships fully preconfigured in S4 sleep state**

An Easy PC system must ship in the S4 sleep state, with all software-related component preconfigured, so the new user can begin work “instantly” upon waking the system. (See the item “System meets Easy PC requirements for system boot, sleep, and shut down” in this chapter for power-related requirements.)

**Note to Reviewers: This requirement is still under review.**

## Connectivity and External Expansion Requirements for Easy PC Systems

This section defines requirements for newer technologies present in Easy PC Systems. These technologies are in excess of replacements for legacy interfaces.

#### **X.11 IEEE 1394 provides easy additional external expansion**

IEEE 1394 provides external expansion additional to USB provisions. This requirement furthers the intent that the end user finds the PC to be expandable without having to open the PC case.

If implemented, the Easy PC desktop must include the following minimum hardware support:

?? One IEEE 1394 host controller with three ports, compliant with requirements defined in *PC 2001 System Design Guide*.

#### **X.12 Cardbus provides easy additional external expansion**

Cardbus provides external expansion additional to USB provisions. This requirement furthers the intent that end user finds the PC to be expandable without having to open the PC case. While Cardbus is an established technology in mobile systems, its inclusion as a desktop expansion has specific considerations.

If Cardbus is implemented, the Easy PC desktop must include the following minimum hardware support:

?? One Cardbus/PCMCIA host controller with support for slot capable of accepting a Type 1 or Type 2 Cardbus or PCICMA card.

**Note to Reviewers: Please comment on the relative usage models for IEEE 1394 and Cardbus. What is the impact to your current plans?**

### **X.13 Easy PC system provides easy communications and networking**

Communication to-the-home and in-the-home are essential features of an Easy PC. The system integrator may provide this capability in a variety of ways, with either fully integrated hardware and software or ready for external expansion.

At a minimum, the Easy PC system must include the following support:

- ?? Built-in or upgrade high-speed internet communications solution that does not require opening the chassis. Software support is automatically configured (system comes preconfigured for this support, or it is installed automatically when user adds solution)
- ?? Built-in networking device to support home networking and internet sharing (10BaseT, HPNA)

**Note to Reviewers: Please comment on how the networking requirements impacts your current roadmaps.**

If communications capabilities are provided using a driver-based modem, AC 97 components, or other software-based multifunction device solution, the implementation must meet performance guidelines defined in the “Core System Guidelines” (common) chapter.

## Checklist for Easy PC Systems

- X.1. System performance meets Desktop system minimum requirements*
- X.2. Easy PC supports ACPI 1.x, wired APIC, and timer circuit*
- X.3 Easy PC meets minimum legacy hardware removal requirements*
- X.4 Easy PC meets minimum I/O hardware requirements*
- X.5 Preinstalled platform software components ensure easy-to-use interface for the end user*
- X.6 Easy PC meets minimum BIOS requirements for legacy removal*
- X.7 Expansion capabilities are accessible to end user*
- X.8 System meets Easy PC power button requirements for system boot, sleep, and shut down*
- X.9 Preinstalled additional software components ensure easy-to-use interface for the end user*
- X.10 System ships fully preconfigured in S4 sleep state*
- X.11 IEEE 1394 provides easy additional external expansion*
- X.12 Cardbus provides easy additional external expansion*
- X.13 Easy PC system provides easy communications and networking*